APPENDIX B ANALYSIS PROCESSES

Introduction

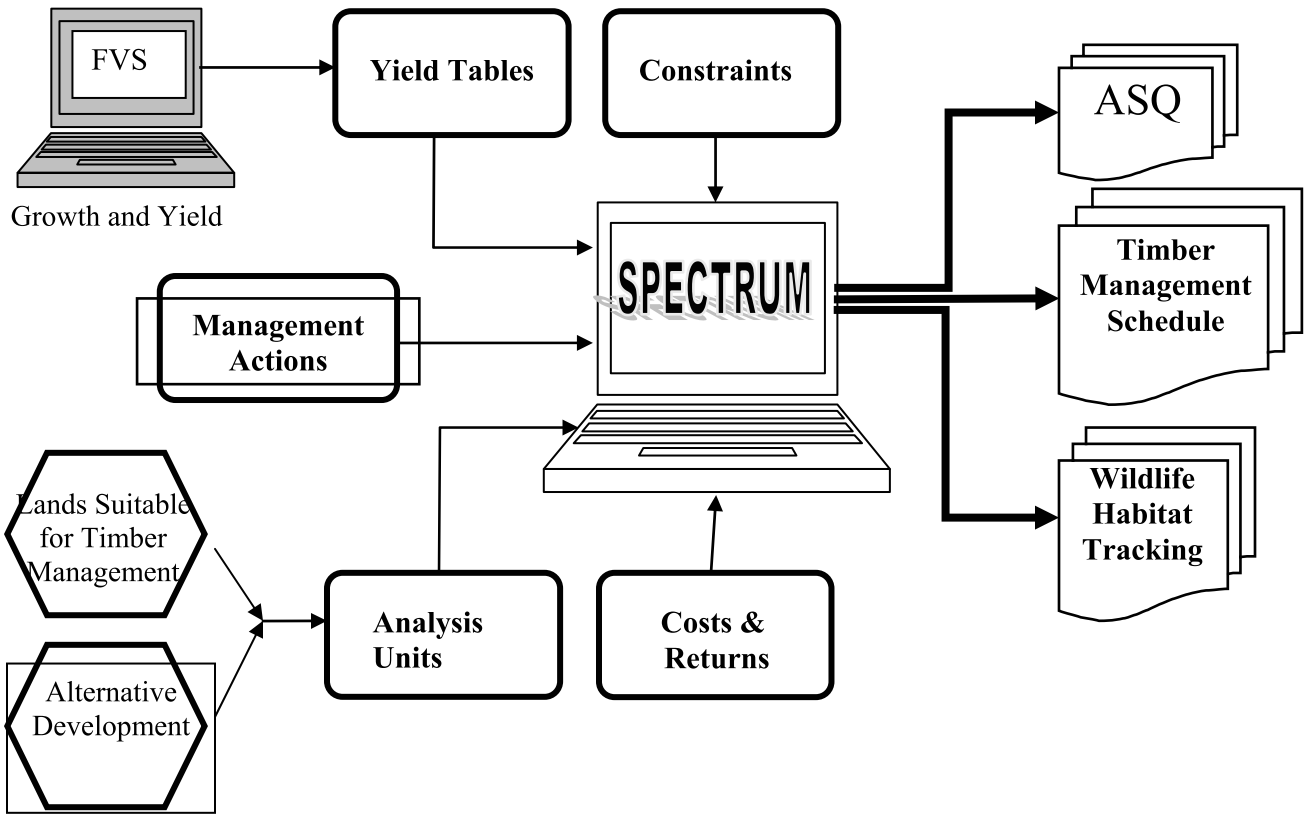
This appendix provides detail on the analysis processes that were used in the Forest Plan Revision process to develop Forest Plan alternatives. These analysis processes produce estimates of what could be expected if the various alternatives were implemented, thereby facilitating comparison of alternatives. The analyses described in this appendix are the modeling of timber harvest schedules and the economic analysis process. The timber harvest schedule analysis was used to determine the allowable sale quantity in each alternative, and was also used in the vegetation affected environment and environmental consequences analysis found in Chapter 3 of this document. The other analysis process described in this appendix is the methodology used in the economic analysis, which was used in the social and economic affected environment and environmental consequences analysis in Chapter 3. The details of the analyses provided here include basic assumptions, modeling components, and inputs, rules, methods, and constraints. Additional details and documents used in the analysis processes are contained in the planning records.

These analyses were performed to fulfill the requirements codified in the Forest and Rangeland Renewable Resources Planning Act (RPA) of 1974 as amended by the National Forest Management Act (NFMA) of 1976. These Acts require that renewable resource programs be based on a comprehensive assessment of present and anticipated uses. The demand for and supply of renewable resources must be determined through an analysis of environmental and economic impacts. The regulations promulgating these acts are in Code of Federal Regulations, Title 36, Part 219 (36 CFR 219).

Timber Harvest Schedule Analysis

The timber harvest schedule analysis addresses the following issue: given a fixed area of land, what activities should be allowed to each land unit over the next 150 years to achieve desired future conditions while meeting all physical, operational, and regulatory constraints. An overview of the timber harvest schedule analysis process, the inputs involved, and the outputs achieved, is described in Figure B-1. The inputs used in this analysis were developed during the planning process. This data development included the identification of lands tentatively suitable for timber harvest (per 36 CFR 219.14), as well as the development of analysis units, timber yield tables, economic information, and management prescriptions, and the determination of suitable acreage within each alternative. The costs associated with various harvest activities as well as the revenue from timber sales by product were also developed for input to the model. The current and proposed Forest Plan standards and guidelines provided the framework for the constraints, the design of analysis units, and the development of possible timber management actions used in the model. The inputs in the analysis are described below.

Figure B-1. Timber Harvest Schedule Model - Process Overview



Yield Tables

The Washington Office Forest Management Service Center in Ft. Collins, Colorado supplied the software and expert advice to create the yield tables. Three major software programs were used: PreSuppose, Suppose and FVSStand (Table B-1). The assistant forest planner and forest silviculturist attended the basic FVS (Forest Vegetation Simulator) training in 2003. A biometrician from the Ft. Collins Service Center conducted a service trip to the Forest in August 2003. During that visit, a field trip was conducted and FVS prescriptions were initiated. This was followed by a visit to Fort Collins in February 2004 by the assistant forest planner and the forest silviculturist. During that visit, prescriptions were modified, yield tables were initially developed, and the FVS model was modified to reflect growth projections, based on research publication and Forest Plan monitoring data.

Table B-1. Software Utilized to Generate Yield Tables

Software	Program Size	Date of Software Version
PreSuppose	616 KB	4/5/99
Ls.exe version 1.10	1,284 KB	8/6/99
FVSStand.exe	316 KB	4/8/00
Suppose (FVS Setup Program)	397 KB	3/30/00
Y2c.exe	19 KB	2/19/99
PressSlf.exe	20 KB	6/1/00

- Software is available from the Ft. Collin's Washington Office Service Center of the USDA Forest Service at http://fsweb.ftcol.wo.fs.fed.us/tm/

Yield tables were developed for different forest types based on the analysis conducted in 1982 by Wayne Kingsley. In the 1980s, growth and yield models for the Northeast had limitations, especially hardwoods. Kingsley utilized data from “A Silvicultural Guide for Northern Hardwoods in the Northeast,” Table 4 and Figure 4 (Leak, Soloman, and Stanely 1969), but made significant modifications based on current yield information. Future yields were based on current yields with increased yields due to silvicultural management. Increased yields were based on growth model projections and modified using professional judgment from silviculturists and research scientists.

The development of the yield tables had two objectives. The first was to provide the information necessary to display volume and stumpage value differences for each alternative analyzed. The second objective was to document the volume yields used in the analysis for comparison with actual yields obtained during implementation of the revised Forest Plan. This will require monitoring and evaluation to determine if the projected yields are actually being realized.

Stand data from the Combined Data System (CDS), was used for projecting growth. Forest inventory data was also available from the Forest Inventory and Analysis (FIA) plots from the Northeastern Experimental Research Station in New Town Square, Pennsylvania. In 1997 and in 1998, 113 FIA plots were obtained on the GMNF. This data was used for the publication “Forest Resource Statistics for the GMNF, 1997” (Wharton, Frieswyk, and Burt 2001). FIA data does not contain stand-level summary data, which serves as the basis for describing national forest system lands. FIA data was used as a reference for growth projections made from the CDS stand data.

The CDS plot data was then translated into a format that was compatible with the FVS program using the Presuppose program. The Presuppose program groups the CDS stand plot data and converts it into data the FVS, whose Windows interface is called Suppose, can read. Plots can be grouped in almost any manner. PreSuppose also displays a summary of the plot groupings with associated forestry attributes (such as average trees/acre, total basal area, volume, diameter,). Standard error percents are also given for each attribute.

Suppose, the Windows interface of the Forest Vegetation Simulator (FVS), is a distance-independent, individual-tree-growing model. The Northeastern version of the model uses The Woodsman’s Ideal Growth Projection System (TWIGS) equations to grow trees, modified to work in FVS. It requires plot data with individual trees identified by species and diameter at breast height (dbh). Important variables include the dbh, site species, and site index for the plot, and crown ratio and diameter growth increment for individual trees. Growth cycles were set at ten-year intervals as needed to create yield tables for SPECTRUM . The Forest Service Plan Silviculturist reviewed the FVS outputs. The outputs were compared with the Kingsley 1982 yield tables and modified based on monitoring results, FIA data and professional judgment.

FVS Stand takes output from Suppose and groups it as needed for the desired yield tables, creating input for SPECTRUM. FVS Stand allowed grouping the individual species and size classes together that comprise one market species group, such as mixed hardwood pulpwood or red oak sawtimber. Thus it was possible to identify the species and product combinations for which we have market-based stumpage values.

The FVS Stand option of creating “age dependent” yield tables was used with 10-year age classes. The 10-year age classes range from X1 to X0 (for example, age 61 to 70, 71 to 80, etc…). The plot groupings created in PreSuppose and processed with Suppose include plots with a range of age classes. Only those plots that met the age class requirements contributed to the volume yield table for that age class. Plots younger than the class are grown to meet the age requirements. If the age class for which a volume is calculated is 61 to 70, all plots younger that 71 years contribute to the yield. For example, the 31 to 40 year old plots were grown by the model into the 61 to 70-age class and the harvest was simulated. The plots that were in the 61 to 70-age class at the time of measurement were not grown before the harvest was simulated.

FVS volumes are shown in cubic feet per acre and International ¼ inch board feet per acre in the yield tables. The volume equations and merchantability are those used in Region 9 cruise program. For cubic feet and cordwood equations the following citation was used: Gevorkiantz, S.R. and L.P. Olsen. 1955. Composite Volume Tables for Timber and Their Application in the Lakes States. USDA Forest Service Technical Bulletin No. 1104. For board feet equations the following calculation was used: Simmons 1942, International ¼ inch, Form class 80.

Minimum diameter at breast height to qualify as sawlogs is 11.0 inches for hardwoods and 9.0 inches for softwoods. Associated minimum top diameters, inside the bark, are 9.6 and 7.6 inches, respectively. Pulpwood size materials have a minimum diameter at breast height of 5.0 inches for softwoods and 6.0 inches for hardwoods. Minimum top diameter (inside the bark) for pulpwood is 4.0 inches.

Several modifiers are available to improve the volume projections in FVS. The following modifiers were used to improve the growth projections. Readcord and Biamult are modifiers that change the diameter growth of individual trees. Mortmult and Fixmort are modifiers that change the rate of mortality for individual tree species. Yields were modified until projections approximated the Kingsley 1982 current yield projections.

The Kingsley 1982 current yields were based on yields by type of cut on the Forest for Fiscal Year 1980 and 1981. It was assumed that they represented medium productivity classes. Yields for the low and high productivity classes were estimated at 92 percent and 115 percent, respectively. Forest Plan annual monitoring data and FIA data was also referenced to judge FVS yield projections. This data was valuable to modify Kingsley's yield tables to reflect implementation of uneven-aged management and impact from standards and guidelines.

Kingsley predicted future yields by using yield information in "A Silvicultural Guide for Northern Hardwoods in the Northeast" (Leak, Soloman, and Filip 1969) for volumes of managed northern hardwood stands. Since oak and northern hardwoods are very similar in stocking and growth characteristics, the northern hardwood yield tables were applied to oak. Future yields for softwoods were assumed to be the same as current yields.

In 2004, FVS projections were compared with Kingsley's steady state yields. Comparison for projections over 100 years is difficult. "Information About Old Growth for Selected Forest Type Groups in the Eastern United States" (Tyrrell et al. 1998) was used to predict stand attributes such as trees per acre, maximum tree diameter at breast height, total basal area, average tree age, average tree height, and standing dead trees.

It was felt that FVS modeling provided better predictions of future yields than the steady state yields used in 1982. FVS used CDS plot data to model future yield. FVS modeling is a tremendous technological improvement for growth and yield modeling. While the FVS yield tables used in SPECTRUM are not perfect, they represent the best predictions possible. Forest Plan monitoring will help judge these predictions overtime.

These yield tables were used in the modeling effort to determine the volumes harvested and stumpage received for both the benchmark runs and each alternative selected for the analysis. SPECTRUM was used to determine the appropriate prescription to apply to each forest type used based on management area direction and constraints. The existing forest type and harvest method was used to narrow and identify the choice of yield table.

Yield tables were divided into productivity classes, site index and site species to identify the correct productivity class to use. Once the forest type, harvest type, and productivity class were determined, the appropriate yield table was identified. To determine the volume of each species and product with its associated value, the stand age is used to correctly identify the appropriate value.

The yield tables were created for a specific forest type or group of forest types. When management area direction indicates stand conversion to another forest type is necessary, the new forest type would identify the successive yields. Natural succession from early to late seral stages was also conducted in this matter.

The actual yield tables are part of the record and are available upon request.

Management Actions

The management action component of the analysis process describes the activities that are applied to a land area to produce a desired outcome. Management actions have an objective or desired outcome which may or may not be a management action, such as:

- Produce as much timber as possible
- Produce as much wildlife habitat as possible
- Improve forest health, or
- A mix of the above

Management actions consist of a set of activities and the resulting output and conditions. They contain attributes, land themes, and schedules. Each management action contains a set of activities that are applied to the land to produce a set of outputs and conditions. Each management action has an emphasis and intensity attribute. The emphasis attribute describes the general management goal, and the intensity attribute describes the varying levels of management used to achieve the goal. For example, a timber emphasis might be regular rotations, 10 to 15 year cutting cycles to produce high quality hardwood sawtimber. The management actions are used for modeling purposes only, however, and will not necessarily be carried into management direction in the revised Forest Plan. The alternatives will determine which Management Area direction will be used and therefore which treatment type(s) may apply. Each Management Area has a different suite of acceptable treatment types.

Analysis Units

The analysis units component of the timber harvest analysis represents the land base input into the model. The forest land area was divided into smaller homogeneous areas called analysis units. The planning area is divided into areas that facilitate land allocation and management scheduling analysis. The stratification is based on a set of layers used to describe the planning area. Layers may include: forest types, productivity classes, existing age classes, rotation lengths, regeneration harvest methods, wildlife habitat structure and other management objectives. Forest planning chose analysis units that were homogeneous and scattered throughout the planning unit. Once a management action (described above) has been determined, the analysis units are grouped by themes. For example, long rotation conifers within deer wintering areas would be grouped to model timber harvesting and winter cover using uneven-aged silviculture. Long rotation conifers outside deer wintering areas may be grouped with long rotation hardwoods in the diverse backcountry management areas. The acreage figures in the analysis were derived from Geographic Information System (GIS) data, which differs from official land status acres by +/- 2%.

Costs & Returns

The costs of the timber program as well as its annual revenue were also components of the timber harvest schedule analysis. Timber program costs and GMNF annual revenue are described in the tables below.

Table B-2. Timber Program Costs used in the SPECTRUM Model	
Activity	**Cost per Acre**
Sale Preparation	$34.34
Sale Administration	$17.24
Road Maintenance	$ 0.74
Average	$52.32
Notes: The costs shown are in 1998 dollars. The data was obtained from the 1995-97 timber program cost analysis and represents the latest information available.	

Table B-3. Green Mountain Annual Revenue and Program Expenses (1995-1999)		
Fiscal Year	**Revenue**	**Annual Program Expenses**
1995	$657,533	$840,000
1996	$966,785	$519,000
1997	$1,078,716	$529,000
1998	$1,066,902	$565,000
1999	$762,930	$404,000
Notes: Timber sales were not offered in 2000, 2001, 2002 and 2003.		

In addition, the 1998 Green Mountain National Forest's cut and sold report was referenced as further background information to determine the appropriate mix of species/products. The 1998 data reflects a timber sales program of 5.8 million board feet. Later data was not used because it did not reflect an appropriate mix for Forest Plan Revision projections. Stumpage prices were obtained from the Northern Woodlands Magazine, Spring 2004 and adjusted based on professional judgment.

Table B-4. GMNF Cut and Sold Report			
1998 Sawtimber	**MBF Harvested**	**2004 Value/MBF**	**Total Value**
Spruce	1003	$240	$240,720
Red Pine	12	$48	$576
White Pine	54	$255	$13,770
Red Maple	500	$237	$118,500
Sugar Maple	1,000	$713	$713,000
Yellow Birch	484	$371	$179,564
Paper Birch	166	$80	$13,280
Beech	131	$186	$24,366
Ash	422	$257	$108,454
Aspen	10	$15	$150
Black Cherry	28	$619	$17,332
Red Oak	260	$578	$150,280
Total Sawtimber	4,070		$1,579,992

Constraints

Various constraints were then input into the model, giving the analysis parameters within which it could run. These constraints include limitations on harvesting, such as harvesting will only be modeled for areas where it is physically and legally feasible. Constraints may also be placed on management actions within analysis units. The constraint may specify a minimum, maximum, or a specific number of acres of an analysis unit that may be allocated to a set of management actions. Parameters on the types of treatment used in the model were also set. For example, clearcuts must retain nine trees per acre. These reserve trees must be selected from trees with the largest 50 percent of the diameters in the stand. In shelterwood treatments, overstory removals that normally occur within ten years after the initial shelterwood cut must also retain nine reserve trees per acre, with a preference to leave hickory, red maple and hemlock. In the shelterwood with reserves method, when the overstory is removed in 40 years, nine reserve trees must be retained, similar to the other treatment types. An additional constraint is that the minimum harvest is 20 square feet. basal area per acre (BA) for all treatment types.

SPECTRUM Program

The linear programming (LP) model SPECTRUM (formerly known as FORPLAN) developed by K. Norman Johnson was selected as the primary analysis tool for National Forest scale planning. SPECTRUM is used to analyze different management alternatives. It optimizes the attainment of desired future conditions (DFCs) by scheduling activities that move existing conditions toward desired ones. This schedule is subject to meeting standards and guidelines (S&Gs), to imposed disturbance regimes, and to projected outputs and effects of time as a result of implementing the alternative. The major strength of this model is its ability to model the effects of constraints on outputs over time. The major limitations of this model, are that activities and projected effects are not spatially explicit and that input and outputs do not consider variability and uncertainity in the input data. SPECTRUM was used to determine the most cost effective schedule of treatments that would produce the desirable outputs and effects given DFCs (objectives) and S&Gs (constraints).

One component of SPECTRUM's analysis is "Resetting Stand Age." This refers to the model changing the stand age at the time of harvest. For example, in the partial cut treatments with regeneration, resetting the age of the stand would occur when the initial overstory is no longer present or when the overstory dies. The age would then be reset to the age of the new forest type that replaces the initial forest type.

Outputs from SPECTRUM analysis include the average annual allowable sale quantity (ASQ) for each alternative, the timber management schedules needed to achieve each average annual ASQ, and indicators for tracking specific types of wildlife habitat. The results of the SPECTRUM model will display how the Forest will look, in terms of species composition and age class distribution, for each alternative. The model will display a set of treatment methods that could be used to reach the desired conditions in each Management Area.

For example, the SPECTRUM model makes choices. From one treatment type (for example, shelterwood with previous thinning) the model could choose multiple stand treatments (e.g. shelterwood removal in decade 4 versus decade 1). The model could also choose how long each rotation will be.

The treatment modeled for one stand can be a sequence of treatment types. For instance, for a specific red pine stand, the outcome of the model, in terms of what treatment is appropriate, might be to either initially apply a thinning harvest that reduces the stocking and introduces regeneration, or the treatment may be a clearcut that converts it to a young stand of northern hardwoods and spruce. The next treatment could be a thinning harvest that either promotes the northern hardwoods or spruce.

SPECTRUM modeled a flat harvest, due to the effect of the Non-declining Yield (NDY) constraint. Without the NDY constraint, there is a natural tendency to have large harvests early, followed by a decline and then large harvests in the later planning periods. The NDY constraint severely dampens this natural tendency. When the harvest level is constrained to be below the long-term sustained yield

(LTSY), the model finds the greatest value and harvest amount over the entire planning horizon by pushing the flat harvest level as high as possible.

Stage II Suitability Analysis for the Green Mountain National Forest

Stage II suitability analysis requires an estimate of the suitability of forest land to produce wood products cost effectively. The appropriate economic measure of cost effectiveness is the present net value (PNV) of all revenues and receipts received from land over the planning horizon, which for the Green Mountain National Forest (GMNF) is 150 years. The forest lands comprising the GMNF include a wide range of tree productivity from highly productive lands to lands that can not produce a commercial crop of timber. The tree species on the GMNF have a wide range of commercial value. Highly valuable species include sugar maple, yellow birch, white ash and red oak. Species such as aspen and hemlock have little commercial value.

To perform the stage II analysis the Forest Service used the SPECTRUM computer model to simulate the harvest and regeneration of trees over the next 150 years using a variety of different silviculture and vegetation management methods as specified by the planning team. These were the same methods considered for Forest Plan revision. SPECTRUM provided the following outputs used for this analysis: timber yields, costs, revenues and the associated net present value.

Present net value is the criterion for determining the economic efficiency of timberlands. All of the vegetation cover types were reviewed by SPECTRUM. SPECTRUM determined that all vegetation cover types were above cost, except aspen. The only silviculture prescription assigned to aspen was clearcut or no management. The SPECTRUM analysis determined that every acre of aspen clearcut had a negative PNV.

Aspen is a short-lived species that could be lost through natural succession to northern hardwoods on the GMNF. The replacement of aspen to northern hardwoods would improve the PNV during the 150 year planning horizon. This would not meet Forest Plan vegetative objectives since aspen provides important wildlife habitat. The revised Forest Plan has an objective of regenerating 110 acres annually with commercial timber sales and 200 acres annually with non-commercial chainsaw felling of aspen regeneration.

Although regeneration of aspen through commercial timber sales would have a negative NPV, it is more cost effective than hand tree felling of aspen with no timber removal. Timber sale appraisals of aspen clearcutting has shown an average cost of $135 per acre to accomplish this work by a logging contractor. This work is funded through reduced stumpage receipts received by the government. Timber sale bidders make their own estimates of the required work on timber sales and adjust their bids for stumpage. The Vermont Forests, Parks and Recreation (FP&R) provides funding to private landowners to regenerate aspen by chainsaw felling. FP& R estimates that it costs between $150 and $250 per acre to accomplish this work by private landowners.

The SPECTRUM analysis also did not select about 7,000 suitable acres of conifers for management. Although these acres had a positive PNV, the model could choose other acres that had a higher PNV. The planning team determined that those conifer acres should remain as suitable timberlands.
Many of the conifer stands are small inclusions within larger northern hardwoods stands across the Forest. Typically, the conifer stands are predominately a mix of hemlock, spruce and northern hardwoods. Many of the stands are within unmapped riparian areas, class II and III wetlands and pockets of winter cover for deer, moose and snowshoe hare. Conifer stands greater than 2 acres are

generally designated as a stand. Stands less than 2 acres are generally considered an inclusion within the larger stand.

While many of these stands are not logged due to wet soils, silviculture is often used to reduce the threat from insect and disease outbreaks. Their winter cover function can be improved through the use of silviculture. High risk spruce and fir are often removed to enhance hemlock regeneration, which provides better thermal cover for deer.

Economic Impact Analysis

Introduction
This portion of the Analysis Process Appendix provides additional details regarding the economic impact analysis. It should provide the reader with a general understanding of the methodology used and some of the models employed in the process. In this context, economic impacts refer to the effect, or impact, a change in the economic environment will have on jobs and income. The changes that are introduced to the economic environment reflect the changes in activity levels, such as recreation use and levels of timber harvest, that are present in each of the alternatives. These various levels of activity cause the number of jobs and income to change. Comparing the levels of change in income and employment from current and between alternatives provides the basis for most of the economic effects analysis in Chapter 3.

Defining the Economic Impact Analysis Area
The economic impact analysis area was defined as the six counties in which the Green Mountain National Forest is located: Addison, Bennington, Rutland, Washington, Windham, and Windsor counties in Vermont. Since the counties are well connected through public road networks and activities on the GMNF are generally spread throughout the Forest, it is reasonable to consider the counties as one economic area rather than as separate economic areas. Most of the data available for economic research is available at the county level, and therefore, the six counties provided a reasonable area in which to examine the economic activity and measure the Forest's economic impact. The six counties include all of the towns with NFS land as well as some other larger communities that are geographically separated from the Forest but tend to be a primary source for goods and services for the adjacent communities. The most significant economic impacts of activities on the Forest can often be felt by communities with NFS lands or in close proximity to the Forest. The analysis of the impacts in the six counties will provide general information on the economic impacts of Forest Service activities in the area adjacent to the GMNF.

Economic Impact Analysis Methodology

IMPLAN Model
The economic effects to the six-county region were estimated using an economic input-output model developed with IMPLAN Professional 2.0. The early version of this software was originally developed by the USDA Forest Service and has since been taken over by a private company, Minnesota INPLAN Group, Inc. (MIG, Inc.). The model uses national input-output tables from the Bureau of Economic Analysis (BEA), secondary economic data at the county level from a variety of public sources, and proprietary procedures to develop an input-output model for a study area.

The Regional Economist assisted the Green Mountain National Forest in developing the IMPLAN model. The income and employment data was derived from year 2000 data. Subsequent analysis was performed using an electronic spreadsheet tool, Forest Economic Analysis Spreadsheet Tool (FEAST). FEAST was developed by the USDA Forest Service's Inventory and Monitoring Institute to apply the coefficients and multipliers generated in IMPLAN to varying levels of inputs by alternative and display the outputs in terms of impacts on employment and labor income.

The impacts to local economies in the model are expressed in terms of employment and labor income. Income is expressed in terms of labor income dollars generated by forest activities and related employment. Employment is expressed in jobs; a job can be seasonal or year-round, full-time or part-time. The number of jobs is computed by averaging monthly employment data from state sources over one year. The income measure used was labor income in 2003 dollars. Labor includes both employee compensation (pay plus benefits) and proprietor's income (for example, profits by self-employed).

Timber
Information on timber stumpage values was provided from recent sales on the GMNF and data compiled by the Northern Woodland magazine (Table B-4).

Recreation
Estimating the economic impacts on the Forest involved the following steps:

1. Determining how many visitors by recreation activity recreate on the Forest in a year. The 2000 National Visitor Use Monitoring Survey (NVUM) (USDA 2001) provided the data for the number of visitors and their activities.
2. Determining how much money the average visitor spends within the analysis area, by recreation activity, on a daily basis. This is referred to as a spending profile. Spending profiles by recreation activity were developed from NVUM data (Stynes and White 2004). Recreational spending categories and the number of visitors a year in each category are shown in Table B-5
3. By recreational activity, multiply the number of visits by activity's spending profile to estimate the amount of money recreational visitors spend in the course of a recreational visit to the Forest.

The visits for backpacking, hiking, and wilderness were adjusted for alternatives based on the acreage of wilderness in the alternative. Wilderness use was assumed to occur at a consistent per acre rate in all Wilderness and Wilderness Study Areas. Hiking and backpacking are classified as wilderness use when they occur in wilderness. The use levels for hiking and backpacking were decreased in the general forest area at the same rate that wilderness use increased in each alternative. It was assumed that the total recreational use levels would not change.

Inputs and Outputs
Table B-5 provides a display of some of the inputs that were used in the economic impact analysis. Both the current situation and each of the alternatives is shown. Fiscal Information is based on 2003 revenues and expenditures.

Economic Impact Analysis Results
The results of the economic impact analysis are expressed in terms of jobs and income. The analysis looks at this from two perspectives. One perspective is the impact the activities that are occurring on the Forest have on sectors of the local economy in terms of jobs and income. Another perspective looks back at the Forest Service, uses some general categories of resource management within the Forest Service's functional organization, and attributes the changes in jobs and income to those resource areas. In a loosely defined fashion, this sets up a cause and effect relationship between the changes by resource area (for example, manufacturing or services). This cause and effect relationship over simplifies the complexity of all of the impacts that an activity has within the IMPLAN model. In fact, the impacts are often spread over hundreds of sectors and sub-sectors. Therefore, the cause and effect is not a one to one relationship. General cause and effect relations are, however, evident in the results. The economic effects analysis section of chapter 3.21 provides detailed tables and interpretation of the results by alternative.

Economic and Financial Efficiency Analysis – Present Net Value (PNV)

Introduction

The economic and financial efficiency analyses evaluate alternatives in terms of their net public benefit. Net public benefit is defined as the “overall long-term value to the nation of all outputs and positive effects (benefits) less all associated inputs and negative effects (costs) whether they can be quantitatively valued or not. Net public benefits are measured by both quantitative and qualitative criteria rather than a single measure or index” (36 CFR 219.3). The first measurement in net public benefit uses quantitative criteria and is included in the financial efficiency analysis. Financial efficiency considers the value of activities and products that have a market cost or value. Essentially, financial efficiency considers things that can be bought or sold. The qualitative criteria are included as a part of the economic efficiency analysis and considered the public’s perceived worth of various activities in the form of assigned values. In this context, these various activities are generally recreation activities. The final economic analysis combines the qualitative criteria with the quantitative analysis using their Present Net Value (PNV) to estimate an alternative’s overall net public benefit. PNVs for each alternative are included in Chapter 3.21, Social and Economic Setting.

Methodology

The economic and financial efficiency analysis uses many of the inputs used in the economic impact analysis for the first decade. The economic and financial efficiency analysis extends the time horizon on these inputs to a period of 150 years instead of the average annual for the first decade of implementation, which was used in the economic impact analysis. The PNV calculation, using an annual discount rate of 4 percent,is then calculated over the entire 150-year period to estimate the long-term value.

PNV Inputs and Assumptions

Recreation

The first decade of input by recreation activity uses visitation and Recreation Visitor Days (RVD) developed from the 2000 NVUM data. Recreation Visitor Days (RVD) are determined by converting the number of visitors to a standardized unit of measure using an activity dependent length-of-stay factor. The 2000 figures were then projected to 2004 RVDs using 10 year growth rate projections from Chapter VI of “Outdoor Recreation in American Life: A National Assessment of Demand and Supply Trends” (Cordell 1999). The RVDs for the Camping/Picnicking/Swimming category, the Hiking/Horseback Riding/Water Travel category and the wilderness category were adjusted for alternatives based on the acreage of Wilderness in the alternative. Wilderness use is assumed to to occur at a consistent rate per acre and was increased for additional Wilderness acreage. Hiking and camping were decreased an equal to the Wilderness use increase. These activities are classified as Wilderness RVDs when they occur in wilderness. Assigned values by activity were established using values from a USDA Forest Service report “Resource Pricing and Valuation Procedures for Recommended 1990 RPA Program.” The Forest Service chose the accounting stance “market-clearing price,” which approximates the price a good would sell for in a competitive market. This valuation technique was applied to “goods” not normally marketed. The “goods” in this case are recreation visitor days (RVDs), a twelve hour equivalent stay or visit, by recreational activity of the Forest. These values were adjusted from 1989 values, the year the study was completed, to 2004 values using a gross domestic product (GDP) deflator inflation index value of 1.3246 (NASA 2004). The adjusted 2004 RPA Program values are shown in Table B-6.

Timber

Revenue from timber sales were obtained from SPECTRUM model outputs gross revenue by decade. Timber program costs were developed assuming the staffing levels would adjust to execute the maximum harvest permitted under the average annual ASQ for each alternative.

Other Programs
Costs and revenues for other programs are assumed constant through the alternatives. Any changes in costs or revenues for one of these programs are assumed to be offset by another program and would not affect the cumulative results.

Table B-5: FEAST Spreadsheet Inputs							
Resource Area	Category	Current Situation	Alt A	Alt.B	Alt C	Alt. D	Alt.E
Recreation	Backpacking	25,840 visits	25,840 visits	25,471 visits	21,113 visits	17,825 visits	21,416 visits
	Viewing	129,200 visits	129,200 visits	129,200 visits	129,200 visits	129,200 visits	129,200 visits
	General	64,600 visits	64,600 visits	64,600 visits	64,600 visits	64,600 visits	64,600 visits
	Snowmobiling	12,920 visits	12,920 visits	12,920 visits	12,920 visits	12,920 visits	12,920 visits
	Hiking	413,440 visits	413,440 visits	413,071 visits	408,713 visits	405,425 visits	409,016 visits
	Downhill Ski	323,000 visits	323,000 visits	323,000 visits	323,000 visits	323,000 visits	323,000 visits
	Cross Country Ski	142,120 visits	142,120 visits	142,120 visits	142,120 visits	142,120 visits	142,120 visits
	Other non-motorized	12,920 visits	12,920 visits	12,920 visits	12,920 visits	12,920 visits	12,920 visits
	Gathering	38,760 visits	38,760 visits	38,760 visits	38,760 visits	38,760 visits	38,760 visits
	Wilderness	19,000 visits	19,000 visits	19,738 visits	28,455 visits	35,030 visits	27,847 visits
	Hunting	64,600 visits	64,000 visits	64,600 visits	64,600 visits	64,600 visits	64,600 visits
	Fishing	64,600 visits	64,600 visits	64,600 visits	64,600 visits	64,600 visits	64,600 visits
Timber	Softwood saw	4 CCF	1,621 CCF	1,704 CCF	1,933 CCF	1,959 CCF	1,849 CCF
	Softwood pulp	2 CCF	704 CCF	766 CCF	825 CCF	708 CCF	768 CCF
	Hardwood saw	89 CCF	15,660 CCF	19,723 CCF	19,361 CCF	18,180 CCF	18,552 CCF
	Hardwood pulp	114 CCF	6,203 CCF	8,545 CCF	7,387 CCF	7,312 CCF	7,536 CCF
Revenues Retained by FS in Thousands (1,000)							
Timber & Roads		$53	$4,754	$5,929	$5,868	$5,485	$5,793
Land Uses		$16	$16	$16	$16	$16	$16
Power		$3	$3	$3	$3	$3	$3
FS Budget Expenditures by Program in Thousands (1,000)							
Recreation		$1,605	$1,605	$1,605	$1,605	$1,605	$1,605
Timber		$773	$1,104	$1,504	$1,328	$1,232	$1,344
Soil, Water & Air		$427	$427	$427	$427	$427	$427
Range		$10	$10	$10	$10	$10	$10
Minerals		$22	$22	$22	$22	$22	$22
Protection		$4,018	$4,018	$4,018	$4,018	$4,018	$4,018
Wildlife & Fish		4997	4997	4997	4997	4997	4997
FS Employment: Permanent		88	91	92	91	91	91
FS Employment: Other than Permanent		23	24	25	24	24	24

Table B-6: Recreation Use Inputs		
Recreation Activity	**Assigned Values/ RVD**	**10 Year Projected Growth Rate**
Camping Picnicking Swimming	$19.19	5.5%
Mechanized travel and viewing scenery	$14.41	15.0%
Hiking, Horseback Riding, and water travel	$22.27	9.8%
Winter Sports	$58.34	5.2%
Resorts	$24.01	
Wilderness	$28.66	-2.4%
Other rec (except wildlife & fish)	$84.09	17.0%
Hunting	$61.67	3.0%
Fishing	$104.31	5.0%
Nonconsumptive Wildlife Uses	$59.68	18.0%

Sources:
Assigned values – Resource Pricing and Valuation Procedures for the Recommended 1990 RPA Program, (USDA 1990)
10 year projections - Chapter VI of "Outdoor Recreation in American Life: A National Assessment of Demand and Supply Trends" (Cordell, H.K. 1999)

Table B-7: Recreation Use Inputs					
			2004 RVDs		
Recreation Activity	**Alt. A**	**Alt. B**	**Alt. C**	**Alt. D**	**Alt. E**
Camping, Picnicking, and Swimming	128,085	123,333	111,935	100,102	115,631
Mechanized Travel and Viewing Scenery	244,048	244,048	244,048	244,048	244,048
Hiking, Horseback Riding, and Water Travel	664,855	660,103	648,704	636,871	652,401
Winter Sports	496,781	496,781	496,781	496,781	496,781
Resorts					
Wilderness	58,339	67,844	90,640	114,306	83,247
Other Recreation (except wildlife-oriented)	77,360	77,360	77,360	77,360	77,360
Hunting	100,431	100,431	100,431	100,431	100,431
Fishing	100,431	100,431	100,431	100,431	100,431
Non-consumptive Wildlife Uses	11,047	11,047	11,047	11,047	11,047

Literature Cited

Cordell, H. Ken, principal investigator. 1999. *Outdoor Recreation in American Life: A National Assessment of Demand and Supply Trends*. Sagamore Publishing, Champaign, IL.

Leak, W.B., D.S. Soloman, and S.M. Filip. 1969. *A Silvicultural Guide for Northern Hardwoods in the Northeast*. USDA Forest Service, Northeastern Forest Experiment Station. 34 p.

NASA. 2004. Cost Estimating Web Site. Available at: HTTP://www.jsc.nasa.gov/bu2/inflateGDP.html.

Stynes, Daniel J. and Eric M. White. 2004. *Spending Profiles of National Forest Visitors, 2002 Update*. Michigan University, East Lansing, MI.

Tyrrell, L.E., G.J. Nowacki, T.R. Crow, D.S. Buckley, E.A. Nauertz, J.N. Niese, J. L. Rollinger, and J.C. Zasada. 1998. *Information About Old Growth for Selected Forest Type Groups in the Eastern United States*. USDA Forest Service, North Central Forest Experiment Station General Technical Report NC-197. 507 p.

USDA Forest Service. 1990. *Resource Pricing and Valuation Procedures for the Recommended 1990 RPA Program*.

USDA Forest Service Region 9. 2001. *National Visitor Use Monitoring Results: Green Mountain & Finger Lakes National Forests*. August, 2001.